The Imperial Forestry Institute
University of Oxford

THIRTY-SIXTH ANNUAL REPORT

1959-60

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THIRTY-SIXTH ANNUAL REPORT OF THE IMPERIAL FORESTRY INSTITUTE ACADEMIC YEAR, 1959-60

Introduction. This is the first year under Professor M. V. Laurie who, as mentioned briefly in last year's report succeeded Professor Sir Harry Champion as Professor of Forestry. Professor Champion who retired on 31 July 1959, after 20 years as Professor of Forestry, trained under Sir William Schlich, the first Professor of Forestry. After a post-graduate year in America, studying forest entomology, Professor Champion joined the Indian Forest Service, and except for a short period on the Staff of the Imperial Forestry Institute, Oxford, he served with the Indian Forest Service until he returned to Oxford as Professor in 1940. All staff members and former students join in wishing him a long and active retirement.

Professor Laurie took his Forestry training at Cambridge under W. Dawson, and also joined the Indian Forest Service. He succeeded Professor Champion as Silviculturist at Dehra Dun, and during the 1939-45 war served as Director of Timber Supplies in India. In 1946 he returned to this country and became Chief Research Officer, Forestry Commission, until he took up the post of Professor of Forestry at Oxford on 1 October 1959.

Colonel A. H. Lloyd retired from the post of Lecturer in Forest Utilisation and Engineering on 30 September 1960, a post which he has held for 32 years. He received his forestry training at Oxford after the first world war under Professors Schlich and Troup, and then was appointed to the Indian Forest Service, serving for 7 years in Burma. In 1928 he returned to Oxford as lecturer in Forest Engineering and Utilisation. He served with distinction in both world wars. In addition to his teaching, he will be remembered by many Oxford foresters through the many continental tours he organised and conducted. We wish him well in his retirement. He will be succeeded by Mr. C. J. W. Pitt.

Students. The number attending courses throughout the year was 43, as well as 3 Advanced Students who had been granted leave of absence, and two Diploma Students for two terms from Queensland and South Africa. In addition, a Russell Grimwade Scholar arrived from South Australia in March 1960, and is hoping to complete his studies for the Diploma in Hilary Term 1961.

Nine students were successful in the examination for the Forestry Honours Degree. The Classes obtained were one First, two Seconds, and six Thirds. Two were Probationers for the Forestry Branch of H.M. Overseas Civil Service and returned to their respective Colonies; two obtained Beaverbrook Fellowships and have gone to the University of

New Brunswick for a year, two were Government Scholars from Ceylon and have returned to Ceylon to take up appointments in the Forestry Branch of the Ceylon Civil Service. One man obtained a post with the Forest Service in British Columbia, one is teaching, and one has obtained a post with the Queensland Forest Service.

There were 10 students in the Third Year, 2 from overseas and one a Probationer for H.M. Civil Service.

The Forest Officers Course was attended by 12 officers from H.M.O.C.S. They came from Northern Nigeria (2), Western Nigeria (2), Sierra Leone (1), Northern Rhodesia (2), Kenya (1), Uganda (1), Nyasaland (1), Cyprus (1) and Trinidad (1). Three Indian Forest Officers from West Bengal, Bihar and Mysore attended the course, and one Ceylonese Forest Officer spent a year here.

One Forest Officer from Thailand and a Professor of Forestry from Yugoslavia spent one term in Oxford.

Research Students. Five students successfully submitted theses for the Diploma in Forestry. The theses were entitled:

'Studies on Forest Soil Moisture Relations.'

'A critical study of current practice in the design, treatment and analysis of thinning experiments in coniferous plantations and its application under Queensland conditions.'

'Variations in tracheid length in wood with special reference to factors other than the usual increase outwards from the pith.'

'Trends of variation from the pith outwards in the wood of some species of *Shorea*.'

'Laws affecting land tenure and land usage in Britain with particular reference to their influence on Forestry.'

Three students are working for the degree of D.Phil., two for the degree of B.Sc., and one for B.Litt.

Prizes. The Schlich Memorial Prize was awarded to B. M. Savory, Assistant Conservator of Forests, Northern Rhodesia. The School of Forestry Jubilee Prize was awarded to J. M. Sykes, who is now studying at Brunswick University, with the aid of a Beaverbrook Fellowship.

Instructional Tours. (1) The Introductory Tour in Britain for students starting the course for the Final Honour School and others unfamiliar with British forestry was made as usual immediately before Michaelmas Term. The tour was conducted by Mr. Edwardson, accompanied by Mr. W. A. Gordon and for part of the time by the Professor and Colonel Lloyd. Utilisation visits were made to the Longhope Turnery, the Parkend Sawmill and the Pine End Plywood Factory at Lydney; State Forests visited were Dean, Tintern, Crumblands and Crychan. The private estate visited was Stoke Edith, and it was with great regret that we learned of the death later in the autumn of the owner, Major H. T. H. Foley, who had conducted a number of parties from the School around the estate woods in the past.

(2) *Western France*. The annual tour to Normandy and the Landes was conducted by Mr. Edwardson, accompanied by Professor Laurie.

The party consisted of the Third Year Students, a student from the Cambridge Estate Management Course, three Forest Officers from India, one from Ceylon, another from Burma and two local Probationer Forest Officers from Sierra Leone, and one from Malaya. On the Normandy part of the tour, Colonel E. Hubault, who makes the arrangements annually, accompanied the party. The usual forests were visited (Lyons, Bord, Bellême, Reno-Valdieu and Mimizan). Utilisation visits were made to the hardwood pulpmill at Alizan, near Rouen, the impregnation works at Alençon and the pulpmill and sawmill at Mimizan. Communal forests of the Landes and the forest fire station at Labouheyre were also visited.

Re-formation of the dune at Mimizan is in active progress, under the direction of M. Jounet.

(3) *Eastern France and Switzerland.* The nine Fourth Year students visited forests in the French Jura and Switzerland during the Easter Vacation. The tour was conducted by Dr. Jones.

(4) *Postgraduate Tour in Great Britain.* This annual visit to areas demonstrating current developments in British forestry was conducted by Mr. Edwardson and Mr. Gordon and, after a lapse of about ten years, was made to Scotland. The party comprised twelve Forest Officers of the Overseas Civil Service, three from India, and one each from Australia, Burma, Ceylon and Malaya. South Scotland only was covered, with visits to the following State Forests: Cairn Edward, Fleet, Ae, Glentress and Carron Valley. Utilisation visits were made to the particle board mill of the Scottish Weyroc Company at Annan and to Messrs. Muirhead and Sons, Ltd., Grangemouth sawmills, glue lamination and joinery factory. In the State Forests, topics ranged from nursery practice, thinning methods, work study and silvicultural research in water catchment problems and use of the method of control in conversion of regular forest stands, the latter demonstrated at Glentress by Dr. W. S. Mutch of the Edinburgh Forestry School. The thanks of the Institute are due to Mr. J. A. B. Macdonald, Conservator, Forestry Commission and his staff, Mr. Henderson of Scottish Weyroc, Mr. Lindsay of Messrs. Muirhead and Professor Anderson of Edinburgh University for the excellent arrangements and hospitality.

(5) *Postgraduate Tour in Sweden.* Ten Forest Officers of the Overseas Forest Service, three Indian Forest Officers and one Ceylonese Forest Officer visited Sweden under the leadership of Professor Laurie and Mr. W. A. Gordon. The tour was organised by Mr. E. W. Höjer, Director General of the Swedish State Forest Service, who also kindly permitted Mr. Ake Malm to accompany the party and act as guide. Among the many places of interest visited were the Royal School of Forestry, Stockholm, where the party was shown the research being undertaken by Professor Björkman, the State Forest School and Nursery at Kolleberga where Mr. P. Sköld acted as guide, the Forest Research Institute, Stockholm where Mr. A. Wiksten demonstrated, and the connected experimental forest at Tönnersjöheden where the party was shown round by Prof. Ch. Carbonnier, who had specially come down

from Stockholm, the Forest Tree Breeding Station at Ekebo under the care of Dr. H. Johnsson and the State Forest Industry Company's factories at Skinnskatteberg (Manager, F. Malmström). The State Forests of Färna, Malingsbo and Linköping were also seen, as was the Nature Reserve near Strömsholm. The private forests belonging to the Uddeholm Co., at Uddeholm, the Katrinefors Company and their wallboard factories and sulphite pulp and paper mills, and the sulphite and sulphate pulpmills belonging to the Mölnbacka-Trysil Company. The thanks of the Institute are offered to the many people, too numerous to mention by name, who so kindly and freely gave their time to demonstrate the work they are doing, and also the very generous hospitality encountered everywhere.

Utilisation Course. The Third Year students and the Forest Officers spent one day in the various sections of the Forest Products Research Laboratory at Princes Risborough. Thanks are due to the Director and those members of the staff who gave demonstrations.

Vacation Practical Work. During the summer of 1959 practical work was carried out during the Long Vacation by several students in the forests of Ontario, and by others in Norway and Sweden, through the generous assistance of the Forest Services concerned.

Excursions. During Trinity Term arrangements were made for Forest Officers to visit the following research centres and estates: Messrs. Wm. Mallinson's Timber Yards and Veneers, London; Alice Holt Research Station (Forestry Commission), the Directorate of Overseas Surveys at Tolworth; the Cirencester Estate, the property of Earl Bathurst; Rothamsted Experimental Station, the Forest Products Research Laboratory, Princes Risborough, and a furniture factory at High Wycombe. The Fourth Year students joined the excursion to Cirencester, and the Third Year students joined the excursion to the Forest Products Research Laboratory.

The Third and Fourth Year students also visited the Hampden Woods, the property of the Earl of Buckinghamshire, the Great Park, Windsor, and the Forestry Commission Woods at Hazelborough.

In addition the Third Year students visited local woods for field study of silviculture and soils. Dr. Jones demonstrated.

Thanks are tendered to all who permitted students to visit their estates and factories.

Discussions. During Michaelmas and Hilary Terms, weekly discussions of forest topics of general interest, selected by the members of the Forest Officers' Course, were organised as usual. During Trinity Term, short papers on selected topics (usually the Forest Officers' 'Advanced Study') were presented by the same group, each paper being followed by discussion.

Seminars on Regeneration of Tropical Forests. Six seminars were held in Michaelmas Term under the leadership of the Professor and members of the staff.

Visiting Lecturers. The usual weekly series of invited lecturers in Hilary and Trinity Terms were given. These lectures, primarily for the postgraduate class and Fourth Year students deal mainly with topics not fully covered by the staff of the Department. The lectures were followed by discussions.

The subjects and lectures were:

Timber imports from the commercial point of view. Mr. E. H. Richardson, of Messrs. Wm. Mallinson and Sons Ltd.

The industrial uses of hardwoods generally, including the economics of the Sudbrook Mill. Mr. C. D. Begley, Forestry Commission.

Natural durability of timber and the prevention of fungal deterioration. Dr. W. P. R. Findlay, Brewing Industries Research Foundation.

Developments in timber utilisation. Mr. B. Alwyn Jay, Timber Development Association.

General developments in genetics and tree breeding. Mr. J. D. Matthews, Forest Geneticist, Alice Holt Research Station, Forestry Commission.

Practical examples of the application of breeding methods. Mr. J. D. Matthews.

Land use problems as affecting forestry. Dr. L. Dudley Stamp, C.B.E., recently retired from the London School of Economics and Political Science.

Forestry and water supplies. Mr. Frank Law, Engineer to the Fylde Water Board, Blackpool.

The work of the Food and Agricultural Organization of the United Nations in Forest Economics. Mr. J. C. Westoby, Forestry and Forest Products Division, Food and Agriculture Organization of the United Nations, Rome.

The application of work study to the production of pulpwood. Mr. J. Zehetmayr, Work Study Section, Forestry Commission.

Arboricides. Professor G. E. Blackman, Department of Agriculture, Oxford.

The place in forestry of mycorrhiza, pseudomycorrhiza. Dr. Ida Levisohn, Bedford College, University of London.

Primitive man in relation to the forest. Professor F. E. Zeuner, Department of Environmental Archaeology, Institute of Archaeology, University of London.

Weather, plant and soil factors in hydrology. Dr. H. L. Penman, Physics Department, Rothamsted Experimental Station.

Assistance from other Departments, etc. Special courses in surveying and soil science were given to the Forestry students by Dr. A. R. Robbins of the Department of Surveying and Geodesy, Dr. R. K. Schofield, and Dr. P. H. T. Beckett, of the Department of Agriculture. Mr. F. Fraser Scott, Assistant to the Reader in Biometry and

Mr. G. B. Masefield, the University Lecturer in Overseas Agriculture, also gave courses to both the undergraduates and post-graduates. The thanks of the Department are extended to all lecturers concerned and the Heads of their Departments.

Assistance to other Departments and Institutions. Mr. W. A. Gordon lectured on Colonial Forestry to the Overseas Administrative Cadets at both Oxford and Cambridge, the Overseas Agricultural Service Officers at the latter University also attending. Mr. Edwardson gave a full course of lectures in forestry in the Cambridge academic year and Mr. Gordon gave three lectures on Forestry to students of the Department of Estate Management, and in the Easter Term Mr. Edwardson took them on a tour of selected State Forests and private estates in south-east England. Mr. Edwardson gave a short course on forestry to the Landscape and Horticultural Classes at Reading University.

Mr. Edwardson served as an Examiner in the Final Public Examination of the Estate Management Course at Cambridge, and as a judge of plantations for the competition organised by the Kent Agricultural Society. He carried out one or two valuations during the year, prepared two or three Dedication plans and advised on seacoast town and school planting schemes and a number of general forestry topics. Mr. Gordon gave a lecture at the Institute of Rural Life at Chelmsford.

Foreign Universities Interchange Scheme. Under this scheme Professor E. A. Laitakari, University of Helsinki, Finland, visited the Department in May and gave two lectures entitled 'The role of fire in Finnish forests and silviculture' and 'The choice between natural and artificial reproduction of forests in Finland'.

In addition he visited Bagley Wood and the New Forest to see types of English forest and the methods of their management. Besides seeing research work conducted in this Institute he also visited the Forestry Commission Research Station at Alice Holt.

Staff Tours. As mentioned briefly last year, Mr. White spent ten months in Africa, having left the Department in June 1959 and returned in April 1960. More is said of the tour in the Forest Botany Section of this Report. Immediately after the end of the year under review, the Professor left to attend the Fifth World Forestry Congress in Seattle, and Dr. Leyton left to attend the Soil Science Congress in Madison, U.S.A. Mr. Thompson attended the International Entomological Congress in Vienna.

Research Field Station. The Yorkshire station at Wykeham has again been used by members of the research staff. Acknowledgement is made of the continued help given by the Silviculturist (North) of the Forestry Commission and by the Research Forester, Mr. Weatherell.

Scientific Societies, etc. Members of the staff have been active on the Councils and Committees of various societies, as in previous years.

Senior Staff. There has been no change in the senior staff during the year. Mr. Edwardson successfully submitted a thesis entitled: 'A study

of the method of periodic inventory for the management of even-aged forest crops' for the degree of B.Sc.

Technical Staff. At the close of the year there were fifteen technical assistants working in the eight laboratories, the Photographer's and the Artist's sections being staffed by two technicians, and the Workshops by three.

Secretarial Staff. There has been no significant change in the secretarial staff during the year.

WYTHAM WOODS

Colonel A. H. Lloyd continued to superintend the management of the woods until July when Mr. F. C. Osmaston took over from him.

The revised working plan, although not yet finally approved by the University Chest or the Forestry Commission, came into effect on 1 October 1959 and its provisions were followed.

During the year the labour shortage was for a time bad owing to the discharge of one man, but later the position was improved by the recruitment of one man who has his own house and of another who shares a house with another woodman. Consequently, at the end of the year the labour force was composed of 7 men although there are only 5 woodmen's cottages.

An area of 16 acres of bare land was planted in the year. But the 1959 summer drought has badly affected the 16 acres planted last year. Thinnings were kept up to date in plantations but in hardwood pole crops a few acres of poor growth were left unthinned. Cleanings and weeding were more or less adequate but brambles have damaged some plantations.

A start in drainage and repair of rides has been made. But it was found that manual clearance of ditches in clay soils is economically impossible. An application has been made for funds to purchase a tractor, mechanical ditching equipment and scrub clearance machines. If these funds are sanctioned a great improvement in ride maintenance and drainage of wet ground for plantations will be possible. In the absence of such equipment recourse will have to be made (as during the current year) for work to be done on contract which is expensive.

Pole thinnings were sold as usual for turnery. Conifer thinnings were sold by auction and private treaty. Prices were not good. The usual sale of about 130 mature hardwood trees fetched a low price owing to poor quality of the trees and lack of demand.

Mr. H. Probitts continued to discharge satisfactorily his duties of Forester of the woods and can now see 180 acres of plantations made under his care since 1946.

BAGLEY WOOD

The annual 9 acre planting programme was carried out, about one-third of it on heavy clay sites. A steady demand for both stakes and sawn timber from the mill reduced the labour available for thinning, which however, continued steadily. Bagley Permanent Sample Plot No. 12 (European larch) was thinned and measured as part of the annual Forestry Commission demonstration of permanent sample plot work.

Professor Champion prepared for St. John's College a review of progress in the wood within the period of the current plan of operations. His general recommendation included the employment of another forest worker: the continuation of small scale experiments to improve the drainage of the heavy clay sites: improvement of mill and yard surfacing.

Visitors to Bagley in the year included the Dean Foresters' Training School, Cambridge University Estate Management course, Reading University Landscape Architects Course, Professor Laitakari from Finland and Professor Krahl-Urban from Hann-Münden.

SILVICULTURE

Dr. E. W. Jones continued in charge of this section, with one assistant.

Teaching. Dr. Jones gave 24 lectures in silviculture to the Third Year students and 8 to the Fourth Year students. He gave 16 lectures in ecology to the Forest Officers and the Fourth Year students. He also gave 6 introductory lectures on their forthcoming continental tours to the Third and Fourth Year students. Dr. Jones also took part in the seminars on the regeneration of tropical forests.

With Dr. Chalk and Mr. Gordon, Dr. Jones is a member of the 'Essays Committee' for organising and improving the written work submitted by Forest Officers.

Research. The completion of work on the 'Kurame' of Northern Nigeria is still waiting for final determination of specimens and soil-analyses.

Some years ago, Dr. Jones began, as time permitted, to abstract information relevant to the history of British forestry from the 'General Views of Agriculture' of the counties of England, Scotland and Wales published by the Board of Agriculture between about 1790 and 1813. The work has now been completed and a digest of the information prepared.

Re-survey of the permanent transects laid out in 1944 in the Lady Park Reserve, High Meadow Woods, was completed, and the task of reviewing and summarising the results has started. This reserve of about 90 acres, on the steep slopes on the left bank of the Wye above Monmouth, is of interest chiefly as being an excellent example of the semi-natural woodland on Carboniferous Limestone. In this district the

woodland is exceptionally rich in species; both our species of oak, beech, ash, wych elm, *Tilia cordata* and *Tilia platyphyllos* are all important components. In 1943-4 parts of the Reserve were cleared except for scattered standards of beech and oak. Birch and ash have been the principal recolonisers, and the dense thickets which developed are now thinning out and becoming penetrable. During recent years many seedlings of *Tilia* have established themselves, mostly in the neighbourhood of coppice stools of this tree. Many beech saplings are also entering. *Salix capraea* is being eliminated, and *Cytisus scoparius* is also dying, apparently from old age as much as from suppression. On shallow rocky soils tangles of clematis have also recently begun to develop.

In the woodland which was not felled the outstanding feature has been the growth of beech, which has made far more girth-increment than any other species, while there is a tendency for *Tilia* and *Sorbus* spp. to drop behind.

ECOLOGY

The pattern of lectures in ecology, given by Dr. G. W. Dimbleby, was the same as in previous years; that is, a course in General Ecology to the post-graduate students and a course in Temperate Forest Ecology to the Third Year undergraduate class.

Dr. Dimbleby's long paper 'The Development of British Heathlands and their Soils' will shortly be going to press for publication as an Oxford Forestry Memoir. A generous grant-in-aid from the Royal Society will make possible the use of colour photographs to illustrate soil profiles, which are notoriously unsatisfactory subjects for black and white photographs.

For the past two years Dr. Dimbleby has been Chairman of a Committee set up by the British Association to plan an experimental earthwork for the study of bank denudation and ditch silting and the many problems associated with buried soils. This was started in connection with the Charles Darwin centenary in 1958 and has attracted the interest not only of archaeologists, but zoologists, botanists, soil specialists of various kinds, geomorphologists and other scientists. The construction of the earthwork was completed this summer on a Nature Conservancy Reserve on the Marlborough Downs and it is expected that a similar experiment will be set up on non-calcareous soil. This venture has already attracted a good deal of press and radio publicity.

Dr. Dimbleby was again Chairman of Examiners for the Final Honour School of Forestry.

Once again a member of the Soil Survey of England and Wales, Mr. P. Bullock, has spent some time in the section learning the technique of soil pollen analysis. We are particularly grateful to Mr. Bullock and to his Headquarters at Rothamsted for guidance on the techniques of thin-sectioning of soils, which Dr. Dimbleby thinks may have special application in his type of work.

TREE PHYSIOLOGY AND FOREST HYDROLOGY

Dr. L. Leyton continued in charge of this section and gave courses of lectures in Forest Soils and Tree Physiology. Dr. E. R. C. Reynolds, with the assistance of Mr. B. J. Kemp and Mr. E. A. S. Ogden concentrated on hydrological research and Miss P. J. Webb assisted in the nutritional work.

Most of the section's research continued to be devoted to the development of techniques for studying the hydrological cycle in forest stands. Experiments have been sent up in an 18 year old plantation of Norway spruce in Bagley Wood near Oxford.

For the measurement of rainfall incident on the forest canopy, 8 standard gauges and a new type of streamlined concentric gauge have been erected at a height of 38 feet, about 10 feet above the general level of the canopy; 2 of these gauges have been fitted with Nipher shields, the remainder with Alter shields. A further 6 gauges, unshielded, have been installed between the tree crowns. Readings to date reveal very close agreement between the Nipher shielded gauges, variability of a few per cent. between the Alter shielded gauges and much greater variability between the unshielded gauges, probably due to variable interception and drip from the crowns. In comparison with the readings of 2 standard gauges, installed in open ground some 400 yards from the plantation, the mean monthly readings of the Nipher shielded gauges, over a period of some months, agreed to within 1 per cent. and those of the Alter shielded gauges almost as well; the unshielded gauge readings were a few per cent. lower during the period January—April but were within 1 per cent. from May to July. More data are necessary before any firm conclusions can be reached.

In the measurement of interception and throughfall, comparisons of standard rain gauge networks (both stationary and moved at intervals) with a network of troughs (dimensions 3 ft. by 2 ft.) have shown that only the troughs consistently provide estimates of throughfall with standard errors of about 5 per cent. of the mean. These findings, together with measurements of stem flow and observations on the pattern of throughfall on the stand are being published.

An attempt is being made to measure transpiration of the trees by measurements of the flow of sap through the stems using a modified thermal flow technique incorporating radio-frequency heating. Apparatus is being constructed for automatic recording.

Two students have carried out minor research projects in the field of water relations. J. M. Sykes investigated the effect of wetting the needles of Scots pine and obtained evidence of reduced transpiration; this suggests that rainfall intercepted by the crowns is at least partially offset by lower uptake from the soil. J. A. M. de Silva working with seedlings of Sitka spruce in soil cultures demonstrated an increasing leaf water deficit and decreasing transpiration as the soil moisture content was reduced from field capacity towards the wilting point.

In the nutritional field, analyses of the data on the growth and nutrient status of Japanese larch growing on a variety of sites in Britain has

been completed and written up for presentation at the Seventh International Soil Science Society Congress (1960). Studies on the growth and mineral nutrition of *Pinus radiata* and *P. contorta* seedlings in sand cultures irrigated with varying amounts of N, P and K have been completed and the results are being analysed for future publication. Data on the uptake and distribution of nutrients in young Scots pine trees, sampled from the field at monthly intervals, continues to be collected.

SOIL MICROBIOLOGY

The short course on the study of soils in the field and the course of lectures on soil organic matter and soil organisms were given to the Third Year students as before by Dr. W. R. C. Handley, who remained in charge of the section.

The production, under laboratory conditions, of mineralised nitrogen and carbon dioxide by soil samples to which the leaf litter of various plant species has been added has continued to be studied. Small differential releases of mineralised nitrogen observed in the first year have been maintained in the second year in the soil samples at the original reaction, whereas these differences are not apparent where lime has been added to the soil. In both cases the release of mineralised nitrogen decreased considerably during the second year in spite of the further application of litter at the beginning of the second year. It is of interest and perhaps of importance that in neither the first nor the second year is there any apparent relation between the mineralised nitrogen released and the carbon dioxide given off by the soil columns.

Mr. C. J. Sanders studied the concentration of reducing substances in Scots pine seedlings, grown in different light intensities, in relation to the suggested influence of reducing substances in roots on the formation of mycorrhizal association.

Mr. C. W. Love continued his work in the Dyson Perrins Laboratory on the polyphenolic protein precipitating materials from leaves and the continued generosity of Professor E. R. H. Jones, Dr. B. R. Brown and the Forestry Commission is gratefully acknowledged.

FOREST BOTANY

Mr. A. C. Hoyle continued as Curator of the Herbarium and Mr. F. White as Forest Botanist. In January a grant from the Colonial Office enabled Dr. B. T. Styles to be appointed to assist Mr. White in the preparation of Botanical Monographs of important forest trees. The rest of the herbarium staff remained unchanged.

Mr. White was absent on sabbatical leave for most of the year (June to April) in Africa—for 6 months as visiting lecturer in Plant Taxonomy at the Department of Botany, University of Cape Town, and for 3½ months in Northern Rhodesia, where an ecological investigation was

carried out with Dr. P. H. T. Beckett of the Department of Agriculture, Oxford.

Teaching. Mr. Hoyle gave his usual courses in Systematic Botany and in the Ecology of Dry Tropical Woodlands, and supervised collecting by students. He also supervised the botanical part of the research undertaken by B. M. Savory on *Pinus insularis* and *P. Khasya* for the Forest Department, Northern Rhodesia.

Research and Advisory Work. (1) Mr. Hoyle continued to summarise his work on *Brachystegia* and to supervise illustration of the more straightforward species by Mrs. Dyer (*née* Chandler). There remain the illustration of some difficult complexes and the redescription of groups and species as now delimited, after the reassessment of the value of some characters. Appeals for special collections and information have resulted in very helpful collections by Forest Departments in Nigeria, Sierra Leone, Tanganyika and Liberia and by Oxford Botany Students, Messrs. Newbould, Jefford and Harley during their Oxford Exploration Club expeditions in Western Tanganyika. Numerous specimens of *Brachystegia* have been named for the Kew Herbarium and for Forest Departments. (2) The page proofs of the *Forest Flora of Northern Rhodesia* were returned to the printers in June. (3) Mr. White continued his revision of the *Ebenaceae* and started the accounts of the family for the *Flora of West Tropical Africa* and *Flora of East Tropical Africa.* (4) Dr. Styles started work on a revision of the *Meliaceae* for Tropical Africa and the account of the group for the *Flora Zambesiaca.* 886 specimens were borrowed from other herbaria for this purpose, and at the time of writing a revision of *Ekebergia* is far advanced.

Forest Herbarium. Of the 4,434 specimens received 349 were sent for identification, all but 18 from Northern Rhodesia; 1,478 were presented by other herbaria, principally the Jardin Botanique de l'Etat, Bruxelles (675) and the Singapore Botanic Garden (295, a collection made in Brunei by Mr. P. S. Ashton); the remainder (2,607) were collected in Africa by Mr. White. Mrs. E. M. Woodley mounted 2,884 specimens and efficiently handled much of the routine work of the herbarium. Identifications totalling 541 were sent—to Northern Rhodesia (427), Nyasaland (62) and Uganda (52). Mrs. A. Dyer identified a thousand or so specimens, which await checking.

Visitors and Enquiries. Apart from the usual number of short visits, the following worked with us for short or long periods: Dr. M. B. Raizada, Head of the Botanical Division, Forest Research Institute, Dehra Dun, India, Mr. F. Endean, Forest Department, Northern Rhodesia, Mr. W. G. Dyson, Forest Department, Kenya, Mr. J. Organ, Abingdon; Mr. H. L. Dunkley, Appleton School; Mr. N. Hepper, Dr. H. Heine and Mr. J. L. Tennant of Kew and Mr. R. Cinatti, Junta de Investigaçoes do Ultramar, Lisbon and Department of Anthropology, Oxford. Sundry identifications and reports, on material correlated with timber specimens and tests, were done by Mr. Hoyle for various departments and individuals.

Mr. W. R. Day remained in charge of the section, assisted by Mr. D. K. Barrett and Miss J. S. Palmer. The usual courses of instruction were given to the Honour School and a course in Forest Hygiene to the Postgraduate students. As usual various demonstrations dealing with problems in forest pathology and hygiene were given.

Work continued on Japanese larch, Sitka and Norway spruce and Douglas fir.

Sitka spruce. Moisture determininations in the boles of trees affected by bark necrosis have shown that special and reduced moisture conditions occur in the sapwood, in areas in which necrosis develops, and the indications are that dying of bark is related to this low moisture status. The determinations have shown the possibility of very great differences in moisture content of sapwood occurring in adjacent longitudinal zones and suggest that the dying of bark is determined by locally adverse conditions in the stem, for water supply. Anatomical examination of extending edges of necrosis areas also suggests that death is due to a physical collapse of tissue; this is consistent with the inability to isolate any organism which might act parasitically.

Douglas fir. A re-examination of trees affected by bark necrosis is being made in the Forest of Dean and Dymock Forest with the cooperation of the Conservators concerned. Clear evidence has been obtained that suspectibility to injury is associated with the strain of tree and that the Interior Dry Belt 'Fraser River' types are more susceptible than Coastal types. This may be important and it is hoped to get further evidence from other places to elucidate the relationship between susceptibility and strain of tree.

Re-examination of affected trees has shown the importance of injury to the phloem in the development of necrosis. There is no doubt that in certain aspects this necrosis centres on phloem injury, and this seems to be related to a state of physiological stress which develops most strongly in branch bases and the main stem, particularly in nodal regions and least in terminal shoots. This problem has become complicated by the appearance of chlorosis and crown debility in Douglas fir which show no necrosis. Affected trees may occur mixed with those that also show necrosis, or they may occur entirely separately. There are indications that this crown debility is a distinct type of disease; but further information is needed. Soil and, in consequence, rooting conditions appear consistently to be of importance in the development of both aspects of disease.

Bark necrosis, stain and decay in the main stem of Norway spruce. Some years ago a rather curious case occurred in Lake Vyrnwy Forest in which a blue stain and also decay in heart wood occurred in high frequency in trees felled during thinnings. Further thinnings showed that other stands were also seriously affected. A preliminary investigation was made. Summarily stated the case is as follows: The stands concerned were brashed about ten to twelve years ago. Many of the

trees had swollen branch bases which probably developed because of early conditions of stand development: these bases were usually removed in brashing; but since such swollen bases remain alive after a branch has been killed by supression, large wounds were often made. Three effects followed: firstly, there was a check in radial growth usually accompanied by a dying of bark round the wound. Secondly, a strong bacterial infection developed in the exposed sapwood with the resulting formation of a zone of bacterial wetwood: the blue staining effect is asociated with this. Thirdly, heart rot developed. These together caused a considerable loss in value. The original examination made by the Forest Products Research Laboratory showed that *Stereum sanguinolentum* was at least one of the organisms which had caused heart rot; this was confirmed. Microbiologically, however, this is a complicated case and requires further examination. The co-operation of the forest owner, Liverpool Corporation and of the Forestry Commission Research branch at Alice Holt is gratefully acknowledged.

British Association. Mr. Day was Chairman of the Forestry Sub-Section at the York meeting, in 1959. The subject of his address was 'The influence of pathogenic factors in the rooting space on the development of even-aged plantations'.

Dying Back of Corsican pine. A demonstration was presented at the Forestry Sub-Section of the British Association, at the York meeting in 1959, showing photographically that the initial and important factors in this disease are physical and not biotic. It was demonstrated that death takes place during the growing season, usually between the onset of growth in spring and midsummer. There was further field work in June 1960 and the Silviculturist (North) and his assistants are thanked for help kindly given.

Pythia associated with root disease. Last year *Pythia* were found to be associated with the dying back of root systems of trees of some size, particularly on heavy soils which are liable to water-logging and often poorly aerated. An interesting example occurred with Douglas fir transplants in a nursery on calcareous grit sand near Oxford. The trees had declined seriously in condition and some had died. Inocula taken from root systems showed the presence of a species of *Pythium* in a large proportion of cases. This close slowly draining soil is easily saturated, though eventually draining and it would seem that there is a close connection between this character and the infection. This fungus, together with two other species of *Pythium,* one isolated from Sitka spruce and one from Corsican pine, were used in an innoculation experiment on Douglas fir, Sitka spruce and Corsican pine grown in soil water culture. A general susceptibility to infection was shown under these conditions and the mycelia used were re-isolated from infected roots of all species. It is believed that this type of infection is much more general and important than has hitherto been recognised in this country.

International Botanical Congress, Montreal, 1959. Mr. Day attended this as a Vice Chairman in the Forest Botany section. He also was a

member of the party which studied Sub-Alpine vegetation and took this opportunity to study the Englemann spruce-Alpine fir forest on the eastern side of the Canadian Rocky Mountains in Alberta.

It is desired to acknowledge the interest shown and help given in the work by Mr. Barrett and Miss Palmer. Any progress achieved has largely been dependent on this.

FOREST ENTOMOLOGY

Mr. G. H. Thompson continued in charge of this section in which there was no staff change. The usual undergraduate courses were given in Forest Zoology and Animal Ecology. Four undergraduates undertook entomological special subjects.

Much time was devoted to preparing for publication the manuscript of an insect/host-tree list of Ghanian Forest Coleoptera.

Research. The seventh annual examination was made of ash and sycamore billets laid down in 1953 in Wytham Wood for the study of insect succession; 4 billets of each species were analysed. Approximately 50% and 15% of the bark, in all cases very loose, remained on the ash and sycamore respectively. The underbark fauna of both tree species consisted mainly of molluscs, worms, woodlice and collembola. The wood of both species showed advanced decay; in sycamore pyrochroid, tipulid and lucanid larvae were present; in ash elaterid and pyrochroid larvae were common and old tunnels of the lucanid *Sinodendron cylindricum* L. were numerous.

Biological studies continued on the alder woodwasp (*Xiphydria camelus* L.) and its parasites. Data were obtained on the position of emergence of woodwasps on horizontal and vertical stems and the influence of temperature and moisture. The method whereby the female *Rhyssella curvipes* locates a host in the wood was investigated, but results were inconclusive.

The preparation of a 16 mm. ciné film in colour of the life history of the woodwasp and its parasites was begun in April.

MANAGEMENT

Mr. F. C. Osmaston remained in charge of management in which there was no major change.

The first course for Third Year undergraduates included 24 lectures in Hilary and Trinity Terms, a tour (which also included Silviculture) in Normandy and the Landes in March and five weeks practical work in the Forest in September. The second course for Fourth Year undergraduates included 16 lectures in Michaelmas and Hilary Terms, two weeks practical work in the New Forest in March and a tour in the French and Swiss Jura in April.

The main course of lectures given by Mr. Osmaston was supplemented by Mr. T. E. Edwardson and Mr. W. A. Gordon who gave some lectures on aspects of management particularly applicable to Britain and tropical Commonwealth countries, respectively.

The practical work in the New Forest consisted in the preparation of a full working plan by each student for an area of 528 acres. The area provided considerable variation in both site conditions and growing stock. Problems to be solved included choice of species, conversion or retention of hardwood high forest, choice of rotation and attainment of sustained yields as well as satisfaction of amenity demands. The practical work was in two parts. In September, the basic data were collected. For this work the students were grouped in field parties which involved sharing the basic data collected. Each student then individually wrote Part I of his plan and submitted it for criticism which he was permitted to embody in his Final Part I. Objects of management were given to the students in March so that on their second visit to the New Forest each could finish his plan with full prescriptions in Part II, being able to check in the field both the previous field work and the application of the prescriptions.

Mr. Osmaston also gave to Fourth Year undergraduates in Michaelmas and Hilary Terms a course of 14 lectures on Silvicultural Systems, and to postgraduate forest officers 3 lectures on special points in management. He also took part in Seminars on the regeneration of tropical forests.

Supervision and assistance were also given to postgraduate students, particularly those from India and Ceylon.

Mr. Osmaston completed the revised working plan for the Wytham Woods and was one of the Examiners for the Final Honour School of Forestry.

MENSURATION

Teaching. The customary course of lectures and practical classes in mensuration was given to both Third and Fourth Year undergraduates by Mr. Edwardson, who also gave a series of lectures as part of a postgraduate course on selected points in mensuration and management, with emphasis on the use of the electronic computer, 'Mercury' for volume table construction and forest inventory assessments.

On the Working Plan exercise, for the first time, field data were sent to Oxford daily from the New Forest for 'Mercury' analysis by a series of programmes specially written for the purpose.

Mr. J. F. Scott (Unit of Biometry) attended the enumeration part of the Working Plan exercise for a few days, advised on the sampling design and the analysis of data and wrote two programmes for future use ('Volbano' and 'Area estimation').

Research. Mr. Edwardson submitted a B.Sc. thesis entitled 'A study of the method of periodic inventory for the management of even-aged forest crops'. Very considerable use was made of 'Mercury' and the principal results of immediate practical interest were (*a*) general and tariff series tables for oak in the Dean, but likely to have much wider application; (*b*) calculation of multiple regressions of crop variables of the main conifers for the quick and accurate estimation of current volume increment per cent., and (*c*) a method of survey of irregular areas

by prism wedge and the subsequent calculation of area and plotting of the survey by electronic computer.

Mr. J. McM. Christie, of the Forestry Commission, gave his annual demonstration of current permanent sample plot methods to the Fourth Year: the plot measured was Bagley No. 12 (European larch).

A start has been made in the analysis of beech data from the Hampden Estate as a first step in the preparation of general and tariff series volume tables for Chiltern and other beech.

Supervision was given to advanced studies by J. W. Bride (Northern Nigeria) and B. M. Savory (Northern Rhodesia) on preparation of volume table by computer: to a diploma thesis on thinning research by G. B. Wood (Queensland), and to a B.Sc. thesis concerned with yield prediction by R. T. Bradley.

Local volume tables for the savannah timber species were prepared by Scott's Selective Cubic regression programme for the Research Officer, Sarawak, at very low cost.

AERIAL SURVEY

The course of eight lectures on photogrammetry and interpretation of aerial photographs was given by Dr. A. R. Robbins and Mr. F. C. Osmaston to postgraduate students in Michaelmas Term. Each lecture was followed by 2 hours' practical work. Some Fourth Year students also attended the classes.

In May postgraduate students visited the Directorate of Overseas Surveys at Tolworth where the whole process of making maps from aerial photographs was seen.

The School of Geography used the Forestry Department's Radial Line Plotter to prepare maps from aerial photographs for the purpose of an expedition to Libya.

The Wytham and Bagley Woods were re-photographed from the air at the end of April by Messrs. Hunting Surveys. The photographs will give a valuable comparison with those of Wytham taken in May 1953.

STATISTICS

By arrangement with the Reader in Biometry, Mr. J. Fraser Scott gave a course of lectures on elementary statistics for Forestry students.

Mrs. Allington's computing work has continued.

WOOD ANATOMY

Dr. L. Chalk continued in charge of the section with Mr. A. A. Shaw and Mr. P. G. H. Franklin as his assistants. The usual undergraduate and postgraduate courses were given. One undergraduate and three forest officers carried out research for special subjects and advanced studies respectively and there were two Diploma students, one D.Phil. and one foreign visitor not taking a degree.

Research. (1) Tracheid length in *Pinus caribaea* Morelet. J. M. Bayne (Trinidad) continued, on plantation grown Trinidad material, the investigation started by S. H. Inchbold-Stevens in the previous year. He was concerned principally with variation of tracheid length within the annual ring with a view to standardising position in the ring for sampling, and used the new technique for measuring length devised by J. Ladell. The growth rings are poorly defined and include numerous false rings. Although there was a general pattern of shorter cells at the beginning of the ring and longer at the end, no correlation could be found with the intermediate zones of thicker walled cells forming the false rings. No entirely reliable position in the ring could be recommended for sampling, and a mixture of early wood cells, either from 3 or more tangential sections spaced through the early wood or from mechanically mixed maceration of early wood was suggested.

(2) *Tracheid length in Pinus patula, and P. radiata D. Don.* G. H. Brister (Kenya) investigated two stems of the former and one of the latter. He found the expected rapid rise of about 100% in length from the pith outwards in each species. Plotting this against number of rings gave a more consistent result than against distance from pith, the age at which the curves flattened being between 9 and 10 years in all three trees whereas the distance varied between 6 and 12 cm.

(3) *The effect of fertilisers on the tracheid length of 1 year seedlings of Pinus radiata D. Don.* W. R. Hartley (South Africa) investigated this problem on material obtained from an experiment undertaken to determine the effect of three levels of Nitrogen, Phosphorus and Potassium in a factorial design on the growth of seedlings. These were grown in pots under artificially controlled conditions and tracheid length was measured by Ladell's method near the pith and in the last formed xylem, using 3 seedings each for 2 treatments. Though there was a positive correlation between seedling height and tracheid length in the outer xylem, analyses of variance showed that the use of fertilisers had no significant effect on tracheid length. Ray number decreased and ray height increased outwards from the pith and the mean length of ray contact per mm. of tracheid length increased.

(4) *Variation of density outwards in stems of Shorea spp., and accompanying changes in wood anatomy.* Myint Aung (Burma) found that density increased moderately rapidly from the pith outwards for 10-16 cm. and continued to rise slowly to the outside (40 cm.). The rise in density was accompanied by a decrease in the percentage of fibres and an increase in the area of vessels. The combined total of ray and axial parenchyma showed little change. There was a marked increase in the elongation of the fibres (intrusive growth) from 60-100% near the pith to about 200% near the bark, with no indication that it had reached its peak at 40 cm. This intrusive growth reduces the mean diameter of the fibres and so was associated with an increase in percentage of cell wall outwards from the pith. Vessel member length increased slightly from the pith outwards for about 12 cm. and then remained constant although the fibres continued to increase in length.

(5) *Density variation in Pinus brutia.* H. A. Hilmi (Cyprus) found that density tends to rise sharply from the pith outwards for 20-30 rings, but that this may be masked by the development of heartwood. Specific gravity decreased upwards in the stem, varying, outside the immature core, from about 0.59 at 5 ft. to 0.55 at 11 ft. and 0.5 at 24 ft.

(6) *Comparison of stem and rootwood in Acer pseudoplatanus L.* R. D. S. Macdonald found that in comparison with the stem the rootwood vessels were fewer and larger, and occupied a smaller proportion of the tissues; the proportion of rays on the other hand was greater in rootwood, the rays being both slightly wider and more numerous.

The Wood Collection. The most important additions during the year came from the Forestry Departments of Sarawak (per L. S. V. Murthy) and North Borneo, and 55 root and branch specimens of British trees collected by P. Porter.

FOREST ECONOMICS

This section continued under the charge of Mr. J. J. MacGregor. Mr. F. E. Balman has been mainly concerned with the preparation of reports and the collection of information for the Economic Survey of Private Forestry. Mr. R. C. Gregson was employed as full-time assistant on this Survey until February 1960, when he left to return to his profession as land agent. Miss J. M. Johnson has been responsible for secretarial work and for the preparation of survey reports, and Mrs. A. Willoughby has also assisted part time. Mrs. A. Gurden came as clerical assistant in April 1960.

Teaching. Lectures and tuition in Economic Theory and Forest Economics were given to the Final Year students. Seminars and study groups for forest officers were also arranged.

Research. Considerable analyses of the data (collected over five years) were necessary for the Summary Report on Costs. Current data on costs and prices on private estates have also been collected and reports on factors influencing prices and on piece-work rates have been prepared. After a visit to the Western Region, Nigeria, at the beginning of 1959 a final report was issued in October 1959 on some special problems of the region. A paper on land use was prepared for the Fifth World Forestry Conference.

Committees. The Forest Economist continued to serve as a co-opted member of the Economic Sub-Committee of the Timber Growers' Organisation, of the Oxon and Bucks Committee of the Royal Forestry Society and as a Council member of the Society of Foresters of Great Britain.

General. After assisting Professor Champion on a land use course in the summer of 1959, the Forest Economist edited the lectures and discussions and prepared a summary of the tours. At the end of 1959 he was secretary at the first discussion meeting organised by the Society of Foresters of Great Britain on Pulp and Paper Industries and edited a special supplement of *Forestry* covering this meeting.

FOREST LAW, TAXATION AND ADMINISTRATION

British Forest Law, etc. Mr. W. A. Gordon gave a course of 20 lectures on British Forest Law, Land Tenure and Taxation to a class of Final Year students. Five took the subject in the Final Honour School of Forestry.

Mr. Gordon also conducted two seminars for postgraduates on the Law of Evidence and Contract, and gave three lectures on the legal aspects of Forest Protection to the Third Year students.

Colonial Forest Administration. Mr. Gordon gave a course of 12 lectures to a class of Final Year students and Forest Officers. Two candidates took this subject as their additional subject in the Final Honour School of Forestry.

FOREST UTILISATION AND ENGINEERING

Twenty-four lectures in Forest Utilisation and sixteen in Engineering were given by Colonel A. H. Lloyd who will retire in September 1960, on reaching the age limit. The usual forest road project was carried out by Third Year students on the Wytham Estate, and also a small bridge project over the Cherwell.

Roads and bridges under construction on the new Oxford by-pass road were visited by permission of the Oxford County Engineer. Sawmills were visited in High Wycombe and also in the Forest of Dean, where the operation of a plywood factory and a wood-turnery were explained on the sites. Practical work was carried out during the summer vacation by several students in the forests of Ontario, and by others in Norway and Sweden, through the generous assistance of the Forest Services concerned.

A practical course in the Institute workshops on the sharpening and maintenance of saws and cutting tools was given to all Overseas Forest Officers who also attended a course of eight lectures on car maintenance, followed by practical work, at the City of Oxford Technical College. They were also given a five-day course on the maintenance of petrol engines at the Land Rover School at Solihull. This included the complete dismantling of Land Rover engines and their reassembly by groups of three officers. This practical course was greatly appreciated.

The Overseas Forest Officers paid a very useful visit to the Forest Products Research Laboratory and also to Messrs. Mallinson and Sons timber yards and veneer exhibition. Sawmills were visited in Scotland during the Easter Tour and several officers also visited Stenner's sawmill factory at Tiverton.

A lecture on Timber Imports was given by Mr. E. H. Richardson, of Messrs. Mallinson and Sons; on Developments in Utilisation by B. Alwyn Jay, Timber Development Association, and Industrial Uses of Hardwoods by C. D. Begley, Forestry Commission.

Membership of the Council of the British Wood Preserving Association, the Technical Committee of the British Standards Association, and the Council of the Empire Forestry Association was continued as usual.

FOREST PROTECTION

The undergraduate course in Forest Protection was, as usual, divided into three sections. Forest fire protection and methods of counter erosion were given by Colonel Lloyd. The legal side of Protection was dealt with by Mr. W. A. Gordon and the economic aspects by Mr. J. J. MacGregor.

SURVEYING

The usual course in Surveying was given in the Trinity Term by Dr. A. R. Robbins of the Department of Surveying to the Third Year students.

LIBRARY

The need for more accommodation came under review. In an effort to relieve congestion a number of non-forestry and duplicate sets of periodicals were sold, and a large collection of duplicate material was despatched as a gift to the Forest Research Institute at Peshawar, Pakistan. Additional shelving in the corridor was completed, and in the Easter Vacation a large-scale move was begun which will involve the entire library. It is clear however that the saving of space which results from these undertakings will give only temporary relief and does not solve the problem of expansion which must be faced in the near future.

Although routine and special work have been hampered by the fetching and carrying necessitated by the Library move, satisfactory progress has been made with the revision of the list of periodicals and serial publications. The final draft is being revised, and it is hoped to have it ready for typing shortly.

A large collection of pre-1934 material was sorted, checked, classified and entered.

Mrs. Cloke continued to revise the book catalogue in accordance with the standards recommended by the Library Association.

A campaign was begun to recall loans, which amounted to over 900 items. With the co-operation of the staff and Bureau, this total was speedily reduced to a more satisfactory number.

The Commonwealth Forestry Bureau's Centralised Title Service produced some 809,704 (781,232) cards and flimsies on the Multilith duplicating machine and distributed them to 104 (95) recipients.

F.A.O. publications have been checked and sections refiled in more logical and correct order, according to the latest statement of organisation from F.A.O.

The *Library Bulletin* continued publication, and more requests were received for copies from outside organisations.

Work on the main catalogues continues to be heavy. 26,562 cards were added during the year.

Staff. At the request of the Professor the Librarian visited the private library of Mr. W. A. Robertson at Petersfield. The Librarian also attended an ASLIB exhibition in London.

Mrs. Cloke was granted special leave from October 1959 to January 1960. Her position was filled by the temporary appointment of Miss J.

Howse, whose quick and thorough ability was most helpful during the busy Michaelmas term.

Miss Beyer and Miss Littler continued as library clerks, and successfully handled a substantial increase in accessions and requests for loans.

The Stock-copy collection was increased by 149 (165) items.

Translations were increased by 64 (76).

New periodicals received 3 (19).

New series, including Annual Reports 55 (51).

Costs. During the year the Library expenses amounted to £3,889 (£3,756), £2,947 (£2,856) of which were on staff salaries, and the balance on books, periodicals, binding and equipment.

Visitors. Professor Laitakari and Mr. A. Sippala (Finland), Mr. Brown, Dr. Little, Dr. Wedding and Professor Wilm (U.S.A.), Mr. Raizada (India), Professor Benic (Yugoslavia), Mr. Keay (Nigeria), Mr. Plumptre (Uganda), Mohammed Alwy bin Suleiman (Malaya), Mr. Anti (Ghana), Dr. Campbell (B.B.C.), Dr. Richardson and Mr. Davis (Aberdeen), Dr. Carlisle (Nature Conservancy), Mr. Dyson (Kenya), Mr. Wolffsohn (British Honduras), Mr. A. P. F. Hamilton (Forestry Commissioner), Mr. Grenning, Dr. Webb and Professor Osborn (Australia), Dr. Jacks (N. Ireland), Mr. Mooney (Ghana), Mr. and Mrs. Church (Kenya), Mr. Kolar (Israel), Dr. Selod (France), Mr. Awunti (Cameroons), Mr. Kanamisu (Japan), Mr. Heybroek (Holland), Dr. Sundberg (Sweden), Mr. Sudhidhani (Thailand).

Gifts. Many valuable works have been received from organisations and individuals.

STATISTICS

ACCESSIONS

Issues of periodicals	1932 (1095)
Current annual reports	213 (169)
Books	160 (160)
Maps	86 (48)
Miscellaneous (pamphlets, etc.) ...	2516 (2270)
	4907 (3742)

LOANS

	Staff	*Bureau*	*Students*	*Visitors*
Periodicals circulation ...	2696 (2774)	—	—	—
direct	351 (167)	181 (268)	231 (255)	420 (443)
Books	209 (191)	74 (39)	782 (924)	70 (83)
Miscellaneous ...	508 (258)	338 (320)	650 (498)	382 (192)
	3764 (3390)	593 (627)	1663(1677)	872 (718)

Total Loans = 6892 (6412)

CATALOGUE CARDS

Subject (Oxford) cards	18006 (18665)
Author (Oxford) cards	8479 (9200)
(Flury) cards	77 (246)
	26562 (28111)

CORRESPONDENCE

Letters sent	1886 (1836)
Letters received	978 (1018)

Sales of Institute Publications: £241. 17s. 10d. (£230. 7s. 10d.).

PHOTOGRAPHIC SECTION

During the year the following major items were dealt with by the Photographer, Mr. H. F. Woodward:

Prints and enlargements	2902 (3957)
Negatives processed	472 (763)
Photomicrographs and photographs ...	317 (374)
Lantern slides	34 (110)
Photographic stencils	31 (including 44,600 copies run off)

Other work included preparatory work on a second stereoscopic album of aerial photographs of Wytham and Bagley Woods, work on 'weeding' the photo collection, in further work on the colour slide card index, maintenance of projectors, dry mounting, heat sealing, also map repairs and slide mounting.

WORKSHOPS

Two metal workers, Mr. E. J. Howell and Mr. I. Abbott, and one wood worker, Mr. J. W. Howkins, continued to work in the workshops. In addition to the usual work of maintenance and modification of existing apparatus the more important equipment made included:

Two pairs library steps, 1 unit of shelves (for instrument cabinet, card index and microscopes), 1 cover for projection equipment, 1 tool box (for transporting tools for students), 1 cover and drawers for Sharples centrifuge, 1 bench grinder table, 1 16-drawer card index cabinet, 5 8-drawer card index cabinets, 1 attachment to camera for microphotography, 1 chisel pruner (spring loaded, for the removal of small branches), 1 drawing apparatus for the projection of micro-slides, 1 filter box in copper (deer study), 1 winder for 'Mercury' computing tapes, 10 galvanised trays, 1 micro-slide assembly for projection of slides, 12 brass test tube baskets, 1 point mount punch for insect mounting, 1 adaptor to fit camera to microscope and 20 automatic rain gauge recorders.

APPENDIX I

PUBLICATIONS

GENERAL

Original Publications

The place of fertilisers in Forestry, by M. V. Laurie, *Journal of the Science of Food and Agriculture*, No. 1:1-8 (1960), and in *Empire Forestry Review*, 39:286-293 (1960).

Forestry in Great Britain, the Commonwealth and Europe, by A. H. Lloyd, *Encyclopaedia Britannica 'Book of the Year'*, 1959.

Review

Thirty-ninth Annual Report of the Forestry Commissioners for the year ended 30 September 1958, *Empire Forestry Review*, 39:247-248 (1960). (W. A. Gordon.)

ECOLOGY

Review

Soils for the Archaeologist, by I. W. Cornwall, London, *Archaeological Journal*, 115:254 (G. W. Dimbleby.)

TREE PHYSIOLOGY AND FOREST HYDROLOGY

Original Publications

Effect of drainage on certain physical properties of a heavy clay soil, by L. Leyton and J. S. P. Yadav, *J. Soil Science*, 11:305-312 (1960).

Effects of Forest Areas on Water Resources and the Technique of Lysimetry: Water and Woodlands, by L. Leyton. (Part of Report on Symposia held in Germany, 8-13 September, 1959). *Nature*, 184: 1185-1188 (1959).

Water and Woodlands, by L. Leyton. *Quarterly Journal of Forestry*, 54:60-65 (1960).

Reviews

Forest Soil Studies in New Zealand: Soil Moisture and Soil Temperature Studies under *Radiata* Pine, by G. M. Will. *Empire Forestry Review*, 38:431 (1959) (L. Leyton).

The Influence of Climate on the Growth of Young Trees, by Ch. Kaminsky-Kröger and Tt. Wilhelmi. *Empire Forestry Review*, 39: 227 (1960) (L. Leyton).

Soil Moisture Contents and their Variation, by W. M. Broadfoot and H. D. Burke. *Empire Forestry Review*, 39:228-229 (1960) (L. Leyton).

Soil Moisture Trends under Varying Densities of Oak Overstorey, by P. T. Koshi. *Empire Forestry Review*, 39:229 (1960) (L. Leyton).

Physical, Chemical and Mineralogical Characteristics of Important Mississippi Soils, by R. R. Bruce *et al. Empire Forestry Review*, 39:232 (1960) (E. R. C. Reynolds).

BOTANY

Original Publications

The Taxonomy of the British Knotgrasses, by B. T. Styles. *Biology of Weeds* (Br. Ecol. Soc. Sympos. 1) pp. 48-54 (1960).

The Ecology and Biology of Parasitism of the Loranthaceae of Ceylon, by W. B. Weeraratna. *Op. cit.*, 189-202.

FOREST ENTOMOLOGY

Original Publications

Trachyostus ghanaensis Schedl. (Col., Platypodidae), an Ambrosia Beetle attacking living Wawa (*Triplochiton scleroxylon* K. Schum.) in Ghana, by G. H. Thompson. *Empire Forestry Review*, 38:420-421 (1959).

Native Farms and Coleopterus Timber Pests in Ghana, by G. H. Thompson. *Empire Forestry Review*, 39:220-225 (1960).

PATHOLOGY

Report to Forestry Commission

The Relationship between Brashing Wounds and the Development of Stain and Decay in Norway Spruce in Lake Vyrnwy Forest, by W. R. Day, D. K. Barrett and Jean S. Palmer. Typed. 18 pages, 13 photographs.

WOOD ANATOMY

Original Publications

Factors affecting Fibre and Vessel Member Length and the Duration of the Juvenile Period in the Wood of the Grenadier Apple Tree, by A. M. Loach (edited by L. Chalk). *Journal of The Oxford University Forestry Society*, 5th Series, No. 8:11-18.

Density Variation in the Timber of Ramin, *Gonystylus bancanus* (Miq.) Baill., by L. S. V. Murthy (edited by L. Chalk). *Empire Forestry Review*, 39:324-29 (1960).

Nutrients and tracheid length in seedlings of *Pinus radiata* D. Don, by W. R. Hartley (edited by L. Chalk). *Empire Forestry Review*, 39:474-482 (1960).

ECONOMICS

Original Publications

Course on Land Use for Forestry and Agriculture, 23 June—29 July 1959. Report on Lectures, Discussions and Tours. Edited by J. J. MacGregor, Department of Forestry, Imperial Forestry Institute, University of Oxford. Mimeographed, 67 pages.

Forestry's Place in Optimum Land Usage, by J. J. MacGregor. Special Paper prepared for Fifth World Forestry Congress, Seattle, Washington, U.S.A., 7 pages.

The Development of Pulp and Particle Board Industries and their Effect on Forest Management, with special reference to the Sandwell Reports. Report of Discussion held at Lyndhurst, November 1959. Edited by J. J. MacGregor. Supplement to *Forestry*. Published by the Oxford University Press, 1960, 67 pages.

Economics and the Use of Land for Forestry, by J. J. MacGregor, *Unasylva,* 14:61-64 (1960).

Some Economic Problems of Forestry in Western Nigeria, by J. J. MacGregor, Department of Forestry, Imperial Forestry Institute, University of Oxford, October 1959. Mimeographed, 184 pages.

Survey of Private Forestry Costs. Summary Report for Forest Years 1951-52, to 1955-56. Jointly prepared by Forest Economics Sections, Departments of Forestry, Universities of Aberdeen and Oxford, December 1959. Mimeographed, 150 pages.

Account of Special Course of Land Use in Forestry and Agriculture appearing under *United Kingdom* in *News of the World* Section, *Unasyva,* 14:95-96 (1960).

Reviews

Changes in the Price Ratios of Sawn Softwood sold by Finland in 1932-38 and 1951-56, by Seppo Ervasti in *Acta Forestalia Fennica,* 67, Helsinki, 1959. *Forestry* XXXIII:225-227 (1960). (J. J. MacGregor).

On the Seasonal and Business Cycle Fluctuations of Finnish Sawn Softwood Sales in 1951-58, by Seppo Ervasti, in *Acta Forestalia Fennica,* 68, Helsinki, 1959. *Forestry* XXXIII:225-227 (1960). (J. J. MacGregor).

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APPENDIX II

I. STAFF ENGAGED IN INSTRUCTION AND RESEARCH

Professor M. V. Laurie, O.B.E., M.A. (Oxon), M.A. (Cantab). Tropical Forestry, Forestry and Land Use, Forest Policy.

L. Chalk, M.A., D.Phil. (Oxon). Wood Structure and Properties.

W. R. Day, B.Sc., M.A. (Oxon). Pathology, Forest Hygiene.

A. H. Lloyd, O.B.E., M.C., T.D., M.A. (Oxon). Forest Engineering and Utilisation.

E. W. Jones, M.A. (Oxon), Ph.D. (Cantab). Silviculture.

G. H. Thompson, B.Sc., M.A. (Oxon). Forest Zoology, Entomology.

T. E. Edwardson, B.Sc., M.A. (Oxon), B.Sc. (For.) (Edinburgh). Mensuration, British Forestry.

W. A. Gordon, M.A., Dip. Anth. (Oxon), Bar. at Law (Lond.). Colonial Forestry, Forest Law.

F. C. Osmaston, M.A. (Oxon). Forest Management, Aerial Survey, Silvicultural Systems.

J. J. MacGregor, B.Sc. (Glasgow), M.S. (Wisc.), B.Litt., M.A. (Oxon). Forest Economics.

W. R. C. Handley, M.A. (Oxon), Ph.D. (Leeds). Microbiology.

L. Leyton, M.A. (Oxon), Ph.D. (Leeds). Tree Physiology.

G. W. Dimbleby, B.Sc., M.A., D.Phil. (Oxon). Forest Ecology.

A. C. Hoyle, B.Sc., M.A. (Oxon). Forest Botany and Ecology.

F. White, M.A. (Oxon), M.A. (Cantab). Forest Botany.

E. R. C. Reynolds, B.Sc., Ph.D. (Lond.), D.I.C., A.R.C.S. Forest Hydrology.

B. T. Styles, M.A., D.Phil. (Oxon). Forest Botany.

II. STAFF OF OTHER UNIVERSITY DEPARTMENTS ASSISTING IN INSTRUCTIONAL WORK

R. K. Schofield, M.A. (Oxon), Ph.D. (Cantab). Soil Science.

P. H. T. Beckett, M.A., D.Phil. (Oxon). Soil Science.

A. R. Robbins, B.Sc., M.A., D.Phil. (Oxon). Surveying and Aerial Survey.

J. Fraser Scott, M.A. (Oxon). Statistical Methods.

III. OTHER STAFF

Secretary: Miss H. M. Edwards

Assistant Secretary: Miss I. Blagrove

Librarian: Mr. E. F. Hemmings

Assistant Librarian: Mrs. M. Cloke, M.A. (Oxon)

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OXFORD FORESTRY MEMOIRS

Nos. 1, 3, 4, 11, 12, 14, 17, 18, 20, 21 and 22 are out of print.

2. **Soil Acidity and its Relation to the Production of Nitrate and Ammonia in Woodland Soils,** by G. R. Clarke. 1924. 3s. 6d.
5. **The Physiography of Southern Nigeria and its Effect on the Forest Flora of the Country,** by J. R. Ainslie. 1926. 4s.
6. **The Financial Return from the Cultivation of Scots and Corsican Pines,** by W. E. Hiley. 1926. 3s. 6d.
7. **The Gold Coast Forest: A Study in Synecology,** by T. F. Chipp. 1927. 10s.
8. **The Forest Industry of Finland,** by W. E. Hiley. 1928. 4s. 6d.
9. **Aerial Survey in Relation to the Economic Development of New Countries, with special reference to an Investigation carried out in Northern Rhodesia,** by R. Bourne. 1928. 7s. 6d.
10. **The Formation of Spring and Summer Wood in Ash and Douglas Fir,** by L. Chalk. 1930. 6s.
13. **Regional Survey and its relation to Stocktaking of the Agricultural and Forest Resources of the British Empire,** by R. Bourne. 1931. 15s.
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Nos. 1-14, 20, and 23 are out of print.

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16. **A Forestry Tour in 1937,** by L. Chalk. 1939. 2s. 6d.
17. **The Influence of Vegetation on Climate in West Africa, with particular reference to the protective aspects of Forestry in the Gold Coast,** by H. W. Moor. 1939. 1s.
18. **The Woody Vegetation of the Coast Province of Kenya,** by I. R. Dale. 1939. 2s.
19. **The Recording of Structure, Life-form and Flora of Tropical Forest Communities as a Basis for their Classification,** by P. Richards, A. G. Tansley, and A. S. Watt. 1939. 2s. (Also in 'Journal of Ecology', 28, 1940, pp. 224-239.)
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24. **An Introduction to the Forests of Central and Southern Ethiopia**, by W. E. M. Logan. 1946. 4s.
25. **The Forest Economy of three Private Estates in Great Britain**, by J. J. MacGregor. 1949. 7s. 6d.
26. **The Arboreal Flora of Israel and its Ecological and Phytogeographical Significance**, by M. Zohary. 1951. 5s.
27. **A Compartive Study of some of the more Important Mechanical and Physical Properties of Trinidad and Burma Grown Teak** (*Tectona grandis* L.), by R. Smeathers. 1951. 2s. 6d.
28. **The Grass, Fern, and Savannah Lands of Ceylon, their Nature and Ecological Significance**, by C. H. Holmes. 1951. 20s.
29. **The Vegetation of British Guiana—A Preliminary Review**, by D. B. Fanshawe. 1952. 10s.
30. **Management Records: the Maintenance of Histories of Forest Management Units in the British Commonwealth**, compiled by N. V. Brasnett. 1954. 6s.
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